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the finger of the right hand on the trigger, and that of the left hand on the tail *d*. On bringing this latter to the position marked by the dotted lines, the head *a* will be thrown out of the notch, the spring *b* will rest on the upper surface of *c*, and the gun will then be discharged on drawing the trigger.

The Society think it right to caution those who may be inclined to adopt the above very simple, and apparently effectual contrivance, that there exists a patent, not yet expired, granted to the Rev. J. Somerville in November 1824, for the exclusive use, under every variety of form, of safeguards for fire-arms, such safeguards being worked by the left hand.

No. VIII.

RECOIL CARRIAGE FOR PIVOT GUNS.

The ***Large Silver Medal*** *was presented to Commander J.* ***Pole****, R.N., for his Method of Mounting Ships' Guns, a Model of which has been placed in the Society's Repository.*

The peculiarity of Commander Pole's invention is that of mounting ships' guns on a double carriage. The lower carriage, or bed, has no motion when the gun is fired, and in consequence is attached by a pivot to the port-sill, which allows the gun to be trained fore and aft as a pivot-gun — a mode of training the easiest and most accurate, but which, with the usual carriage, is inadmissible, on account of the enormous strain on the port-sill which would be occasioned by the recoil. The upper carriage carries the gun, and moves on the lower carriage; but in this the recoil is stopped by a geometrically increasing resistance, so void of all sudden shock as to produce no injurious strain on the pivot to which the bed is attached.

The plan has been tried with success on board his Majesty's ship Excellent, at Portsmouth; but these experiments having been made in still water, it yet remains to be proved how the plan would answer in a sea-going ship.

Plate II., fig. 1, is a side elevation of the gun and carriage. Fig. 2 is a top view of the carriage and slider without the gun. The gun in these two figures is not run close out, in order to shew the disposition of the running-out tackles. Fig. 3 is a back view of gun and carriage. Fig. 4 is the muzzle end of the gun, with slider and trucks, and only a section of the carriage-sides *a a*. Fig. 5 is the slider separate. *a a*, the two sides of the carriage made very parallel; *b b*, fig. 1, the outer end and transom under it; *c*, figs. 1 and 3, the inner transom. The sides *a a* are secured together by the transoms, and by a strong iron strap *d d*, fig. 1, which passes round the breast; *f f* the slider, which, when the gun is run out, rests its inner end on the transom *c*; the other end hangs only on the trunnions by strong iron hooks *g g*, the plates of which are let into the sides of the slider, and secured by bolts. Now this slider, being fixed to the gun by the hooks, is to grip hold of the parallel sides *a a* of the carriage, with a tightness increasing as the gun recoils, by which the momentum will be overcome by the time it has run in.

The only contact of the gun and slider *f* with the upper surface of *a a* is through the trucks *e e*, which are free to roll, so as yet friction on this surface is not used;

but the plates of the hooks *g* extend below the slider, as shewn at *h h* in figs. 4 and 5, and have holes to receive the strong iron bar *i*, shewn separate in fig. 6. This bar lies close under the slider, and its round ends project under the sides *a a*, to receive on them the saddle-plates *j j*; two views of one is shewn in figs. 7 and 8. These saddle-plates alone might be made to rub against the under parts of *a a*; but, for the sake of adjustment, other plates or caps, shewn separate in figs. 9, 10, and 11, are laid on; and between them and the saddles any packing of card or canvass may be put, in order to obtain the exact degree of tightness; these saddle-plates are kept on by screw-nuts with handles *k k*. The trucks *e e* and the saddle-plates *j j* now hold the sides of the carriage between them. If the trucks were placed exactly over the saddle-plates, and the gun with its slider had no other support, the preponderating weight of the breech would cause so tight a grip that it could not slide; and the greater the force of recoil, so much tighter would it be; so something must give way, or all go together. Next, if the trucks were so placed that their centres stood at an angle of 45° with the saddle-plates, the proportion of the parts happened to be such that the sliding pressure would only be about twice the weight of the gun's breech-end, then half or a quarter of that distance would give a pressure of four or eight times that weight; therefore it is evident that an angle may be chosen whose pressure shall be just enough to stop the recoil by the time it has acted through the length of the sides *a a*. But this alone would be an equal pressure; it has to be made into a geometrically increasing one, to secure the ability of checking the recoil in the given length of slide; and to make the pull on the ship's side begin from almost nothing, and gradually increase to the sufficient pull, void of all shock or violence. This is done by placing the trucks still nearer to the perpendicular over the plates, so as to give more grip than enough. Now this greater force is to be eased by supporting the breech-end of the slider so much as scarcely to let its weight act when the gun first begins to recoil, and this support is gradually to fail it as the gun runs in. This is very simply effected by making the end of the slider *f*, which rests on the transom *c*, a very little lower than its other end; and, as the trucks are not quite over the sliding-plates *j*, this lower end being held up by the transom, will ease the grip between *e* and *i*, fig. 1, almost to nothing; but as the gun runs in, the higher parts of the slider come over the transom; it therefore supports the slider less and less till it fails it altogether, and leaves the whole weight hanging on the grip, as shewn by dotted lines. Thus there will be a progressive increase of tightness, which will progressively overcome the recoil, with a soft pull and no shock or jerk. The gun, having run in, retains its hold, and cannot be run out till the breech-end is raised again to its former level, or a little more, by the rolling hand-spike *l*. This brings the trucks nearer over the sliding-plate, and quite removes the grip; the gun then rolls out easily along the straight surfaces of the sides *a a*, on which there are prominences *m m* to stop the trucks at the right place. The pin or pivot *n* is made with a solid plate or flanch, which is dove-tailed into the port-sill, and fixed with four bolts. The strong iron strap *o* is jointed by two ring-bolts to the carriage: it drops on the pivot *n*, and is followed by a screw-nut flush with the port-sill.

Having now described the principle by which the recoil may be effectually overcome, I will shew how the effect may be increased or doubled, more particularly to suit weather-guns. Thus far the friction only of the saddle-plates *j j* against the under part of the carriage-sides has been used, and that only compressed by the preponderating weight of the breech, because it is necessary to leave the trucks free to roll out; but the whole weight of the gun as a slider may be added, and the friction doubled, by sliding on the upper surface instead of rolling. For this purpose two wooden shoes *p p* are placed behind the trucks *e e*, so that when the gun recoils the trucks may run on them, and slide instead of rolling; this doubles the friction, and adds the whole weight of the gun to it, there being as much friction from the shoes above as from the plates below. The shoes *p p* are joined together by an iron strap; a top and aft view of them separate is shewn in figs. 12 and 13. They have two guide-pins *q q*, which project down within the sides *a a*, to keep them correctly on its surface. On the slider *f*, also, are fixed two pins *r r*, for the shoes to back against; these carry them after the trucks when they roll out. When these shoes are not wanted, their iron strap is placed behind the pins *r r*, so that the trucks cannot roll on them. Fig. 14 shews the place of the shoe whilst the truck is on it, and a pin *r* behind it.

There is another security which may be used with weather-guns. By referring to figs. 7 and 8, it will be seen that the saddle-plates *j* have also vertical plates; these may be bound against the sides *a a* by the screw-nuts *k*, as shewn in figs. 1, 2, and 4, tight enough to prevent the gun ever running in of itself. If the breech-end of the carriage *a a* is made about the eighth of an inch wider than the other, this grip will also be an increasing one, and may be added to the other checks of the recoil: of course the nuts *k* must be eased to let the gun run out.

The rollers *s s*, on which the carriage stands, are made to turn in the transoms *b* and *c*, as shewn in the section fig. 15, and may be fixed by the binding-screws *t* in any position suitable for moving whilst the carriage is in place, as in figs. 1 and 2. They are fixed with their axis directed towards the pivot *n*, by which the whole may readily be moved to any degree, which is marked on the deck, for the purpose of accurately training either fore or aft. When a weather-gun is directed low down, it is so much inclined to the carriage, that its recoil tends to lift it off. This evil may be much removed by making the swivel-pins of the aft rollers *s* into screws; then, by turning them round, the breech-end of the carriage may be raised to stand much nearer in a line with the gun. In fig. 3 is shewn an index *u*, pointing down to the degrees on the deck. In fig. 2 is shewn, by dotted lines, the place of eight pulleys (the same purchase as now used for heavy guns); four of them are in the breast of the slider, as shewn in fig. 4; a bent rope is attached to the inner middle of the carriage end, and, passing round the different pulleys, the two ends come out at *v v*. These help to run out the gun; the pins which pass through these pulleys are made to take out, for putting in the ropes; the tail of the slider has a ring-bolt sunk in it at *w*, figs. 3 and 5, for hooking on the relieving tackle; also in figs. 2 and 3 are shewn the ringed ends *x x* of a plate, which passes under the transom *c*, for hooking on the train tackles. For the use of hand-spikes, two cleats or chucks *y y* are fixed to the transom *c*. This principle is also applicable for pivot-guns, either for steam-boats or other vessels; and the advantage it has over the usual way of mounting pivot-guns is, that the gun may be kept considerably lower down, and still have as much elevation as may be considered necessary. The first figures represent a gun of the exact height required for a port; but for steam-vessels the slider *f* may be placed very near the deck; and instead of having the wooden transom *c* to rest on, a broad iron plate may be substituted, the ends of which are suited to receive the rollers *z z*, as shewn in fig. 16, which is an inner view of a carriage so lowered. Through this plate the pivot may be placed.

No. IX.

IMPROVEMENTS IN SHIPS' RUDDERS.

The LARGE SILVER MEDAL was presented to Captain JOHN LIHOU, R.N., for his improvements in Ships' Rudders, a Model of which has been placed in the Society's Repository.

28th April, 1834.

HAVING in 1823 suffered much from an accident which occurred to the rudder of a ship I then commanded, it appeared to me that rudders were most improperly hung; and in 1829 I obtained a patent for an improvement in the rudder-hangings of ships.

Since that period my attention has been chiefly directed to the perfecting of that important governing agent, the rudder itself; the usual form, construction, and fitting of which seemed not less faulty than was the method of hanging rudders previous to my patented invention. I